

Chapter 1

Analysis of Mobile Phone Call Data of Istanbul Residents

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ABSTRACT

In this chapter, we analyze call detail records of subscribers of a major cellular network provider in Turkey with a focus on subscribers that reside in Istanbul. We consider a sample of 10,000 opt-in subscribers, chosen proportionally to the population density of each district of Istanbul. The anonymized cell phone usage data for 6 weeks are combined with demographic and subscription package attributes. Our methodology consists of data retrieval and cleaning, analysis and visualization. The analysis aims to extract information to be used mainly in disaster preparedness, marketing and public service design, and is categorized under: 1) understanding call habits in terms of call duration and call location with respect to gender and age categories, 2) tracking population density changes by time and district, 3) segmentation of people visiting specified locations, 4) information on mobility of disabled subscribers, and 5) international travel patterns by roaming data analysis.

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INTRODUCTION

Telecommunication companies have diversified demographic and socio-economical information about its subscribers. Until recent years, information regarding subscribers has been used mainly for targeted marketing activities. However, with the wide-spread usage of mobile phones, an unprecedented amount of data accumulates continuously. As subscribers make voice calls and send/receive text messages over time at different locations, they leave a spatio-temporal trace. Analyzing spatio-temporal data created by mobile phone subscribers has the potential to generate information that finds value in diverse areas such as urban planning, traffic control, sociological analyses including human mobility patterns, public relations management, disaster preparedness, marketing, and creating new business models.

Main objective of this study is to create meaningful information along different dimensions to show examples to unlimited opportunities lying behind user generated spatio-temporal data. We analyzed the call detail records of subscribers of a major cellular network provider in Turkey. We focused on subscribers that reside in Istanbul. Istanbul is one of the most densely populated metropolitans globally. It is the business and cultural center of Turkey with over 14 million residents. At the same time, the metropolitan city attracts millions of visitors annually worldwide. As such, the city provides a good example of urban mobility.

Mobile traffic volume is significantly high in Turkey and has been increasing steadily within the last decade. In the third quarter of 2014, total volume is estimated as 53.1 billion minutes (Turkish Information and Communication Technologies Authority (TICTA), 2014). With an average monthly mobile usage time of 370 minutes per subscriber in 2014 third quarter, Turkey was the country with the most mobile phone calls compared to European countries. As of September 2014, nearly 72 million mobile subscribers existed in Turkey, corresponding to a mobile penetration rate of approximately 112%, when the 0-9 age population is excluded (TICTA, 2014). The GSM-based mobile communications service provider, whose data is analyzed in this chapter, is one of the leading operators in Turkey. We refer to this operator in the remainder of the chapter as TelCo. TelCo provides its services through 30 thousand base stations throughout Turkey and covers 99% of the population. TelCo is also one of the biggest GSM operators in Europe in terms of subscriber numbers. TelCo does not only provide telecommunication services but also data and Internet services, institutional products and mobile marketing solutions.

We took a sample of 10,000 subscribers residing in different districts of Istanbul. The subscribers in the sample were chosen proportionally to the population density of each district of Istanbul. Their cell phone usage data was provided for 6 weeks. Throughout our study we have taken measures to preserve individual privacy. We used anonymized data and present only aggregate results. Opt-in customers give

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